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VIRTUAL PRINTING EXPERT BOT AND AVATAR SYSTEM

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Virtual printing expert bot and avatar system

1. Abstract

Digital printing presses are very sophisticated and consist of many features. As such, they are not easy to operate. A virtual printing expert system was designed in order to assist the press operators personally, and make their printing experience easy, smooth and fun, while ensuring high quality prints with high utilization.

The system consists of a virtual figure, with: “eyes” (video camera), “voice” (speaker) “ears” (microphone), “brain” (analytics engine, Deep Learning models, cloud and on-premise AI services) and personality.

Like a human, the virtual expert can talk & listen, write & read, watch, recognize, ask & answer questions, tip, direct and recommend. It provides a natural way to interface with the press and has access to knowledge content and service tools.

2. Problem statement

Printing presses are designed with great flexibility and have become more and more sophisticated. As such, they contain many features and options which evolve over time. Operating a digital printing press, while utilizing all the latest and greatest features requires high level skills and comprehensive ongoing learning & training. We are witnessing knowledge gaps in operating the press which often result in low print quality, low utilization and even machine down events, and high levels of frustration. It has become clear that we must find a way to make the relevant knowledge accessible to the operator, when it is needed, at the required detail, and in the most natural way. We needed an immediate solution which must take into consideration the fact that it is expected to operate on a noisy printshop environment which might be less tolerant for common voice interfaces solutions.

3. Our solution

A virtual personal printing expert bot, based on cloud PaaS services, with supportive hardware (camera, microphone and speaker), that simplifies press operation by naturally engaging in a conversation (voice & text), answering questions and executing commands. It recognizes the operator and fits the press features to the operator’s level, cueing the operator when needed, while utilizing the press analytics engine. The printing expert is seamlessly connected to all the goodies available such as knowledge and service documents repository.

The unique value proposition: Operating the press becomes natural and easy.

- Natural spoken and written language
- Knowledge and assistance are accessible when needed and adapted to operator / service engineer level
- We, as vendors get to understand what is done on the press including which parts are replaced and more.

3.1. Functionality:

3.1.1. Conversation:

- Natural speech (voice)
- Text
- Understands the utterances and intents
- Initializes conversations when needed

3.1.2. Operator recognition and related cognition:

- Face detection and operator face recognition
- Retrieves operator's level, courses and operating data
- Personalizes printing experience per operator's level and needs
- Adapt press features to operator's level
- Adapt tips and assistance level to operator's knowledge and experience

3.1.3. Press parts recognition and related cognition:

- Recognizes press spare parts when the operator approaches the press with the part
- Checks the press status and makes sure the part really needs to be replaced
- Asks the operator relevant questions regarding the reason for replacing the part, makes a record of that
- Tips the operator in case the part replacement is not required
- Asks if the operator need help / instructions to this specific part replacement and brings up a relevant video or written user manual chapter

3.1.4. Recognizes and reads / deciphers barcodes:

- Barcodes detection and reading
- Used for definitions of substrates and consumables in case the operator needs help recording their properties in the system

3.1.5. Printing Expert:

- Press operation real-time guidance: Connected to all relevant on and off press databases using a powerful search engine and answers "How", What, Where, etc. "questions.
- Press status: Connected to the press IOs and answers press related Jobs, HW and process status questions
- Statistics: Provides analytics and answers jobs and shifts statistical questions
- Look ahead and printing optimization: Connected to press printing jobs queue, jobs and press definitions and configuration, status of paper path and look ahead to find mismatches, wrong definitions and missing required consumables / colors / substrates and alert the operator and helps her to correct.

3.1.6. Trains the operator:

- During "quiet: times, offers" On-the-job" training to the operator based on operator's level
- Generates press related quizzes and provide grades that are converted to points accumulated for prizes
- Provide the operator links to their next formal training and motivates them to take it

3.1.7. Commands Executer:

- Connected via API to the press and executes operator's verbal commands such as "print", "stop", "show screen xyz"

3.1.8. Shifts handshake:

- Provides an overview of last shift: Gets from the operator at the end of the shift, the most important information and passes it to the next operator at the beginning of the shift

3.1.9. Alert on issues:

- Based on press status, statistics engine results, can generate automatic alerts that are sent to the operator or service center

3.1.10. Automatically order parts:

- Based on press status, operator's requests and statistics, can automatically order parts and submit a service call

3.2. Main Components: (see attached figure 1)

3.2.1. HW:

- A standalone PC with cloud connection connected physically to the press pc, or use the press PC
- An off the shelf rotating video camera or stills camera
- A head set for the operator (Microphone and speaker)
- A microphone and speaker connected to the PC

3.2.2. SW (General):

The Personal Assistant software will consist of 3 parts:

- A web site to host the Personal Assistant UI
- Cloud services to support the Assistant application
- Mediator application to receive the Assistant requests and operate the press accordingly and then provide feedbacks back to the Assistant

3.2.3. SW on PC:

- An external PC will be used to run a web browser which will host the Assistant web page and the scripts behind it.
- The reason for using an external PC is because the high usage of PC resources required when the assistant is running.

3.2.4. SW on Press PC:

- A thin application will run on the Press PC. It will interact with the Assistant (Web Socket) on one side and with the Press software on the other side (over the Press Software service bus).
- The only purpose of this small application is to mediate between the Assistant application and the press software.

3.2.5. SW on Cloud:

The following cloud services will be used to support the Assistant application (as depicted in figure 2):

- Nosql database – stores mappings of users and their records (etc.)
- Deep learning models and data (training and inference):
 - Face and press parts and QR codes/barcode detection
 - Identify and map the operator's possible responses and variations

4. Summary

A one of a kind integrated printing expert bot and avatar that is a combination cognition and know-how with many off the shelf services that adapts itself to the operator's level, exercising a unique look ahead and cognition which works in an industrial environment and continually improves with time.

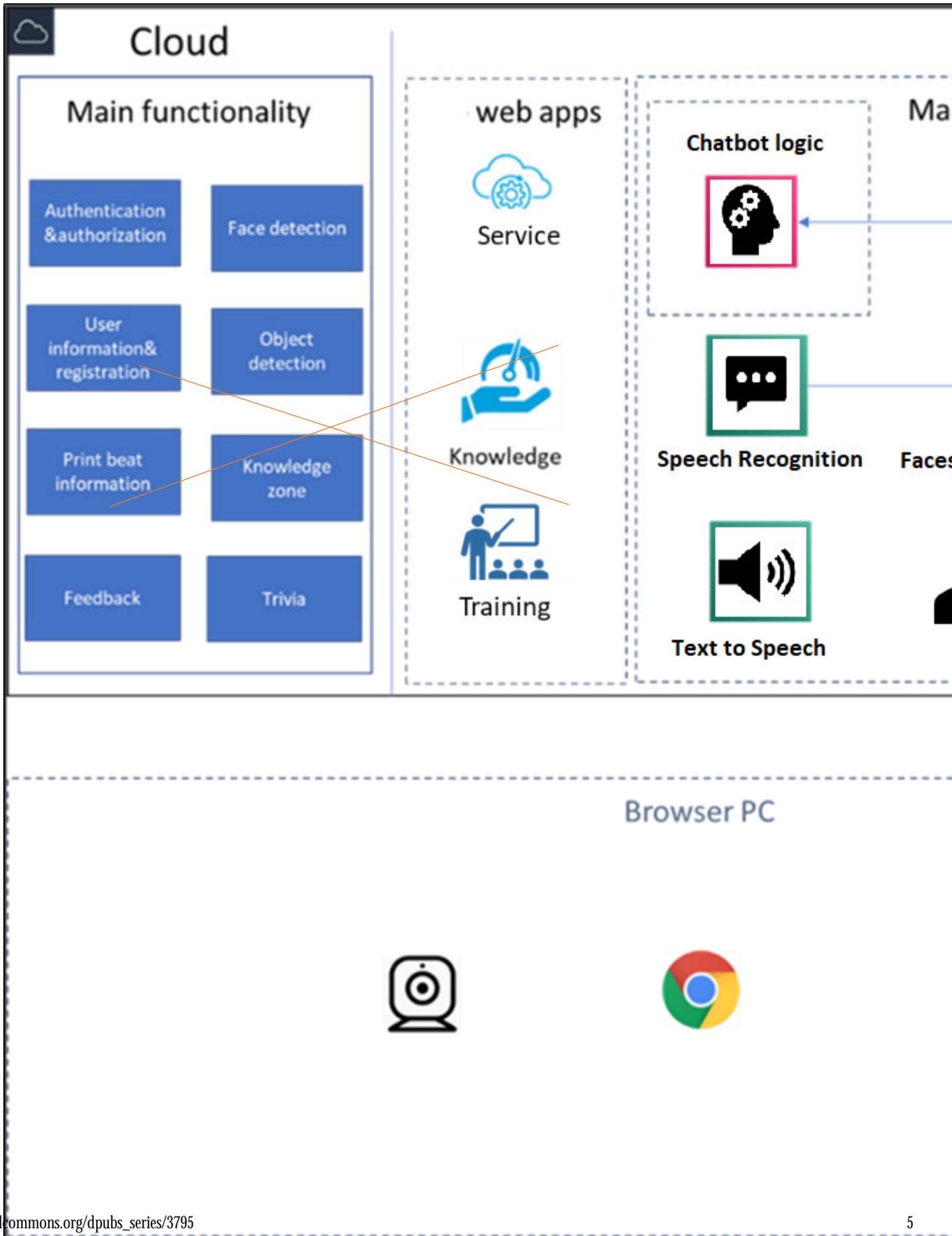


Figure 1: System block diagram

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